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ASSIGNMENT BOOKLET
SCN2261 Physics 20
Module 1 Assignment

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Date Assignment Submitted: ____________	(If label is missing or incorrect) Student File Number: ____________	Assigned Teacher: ____________
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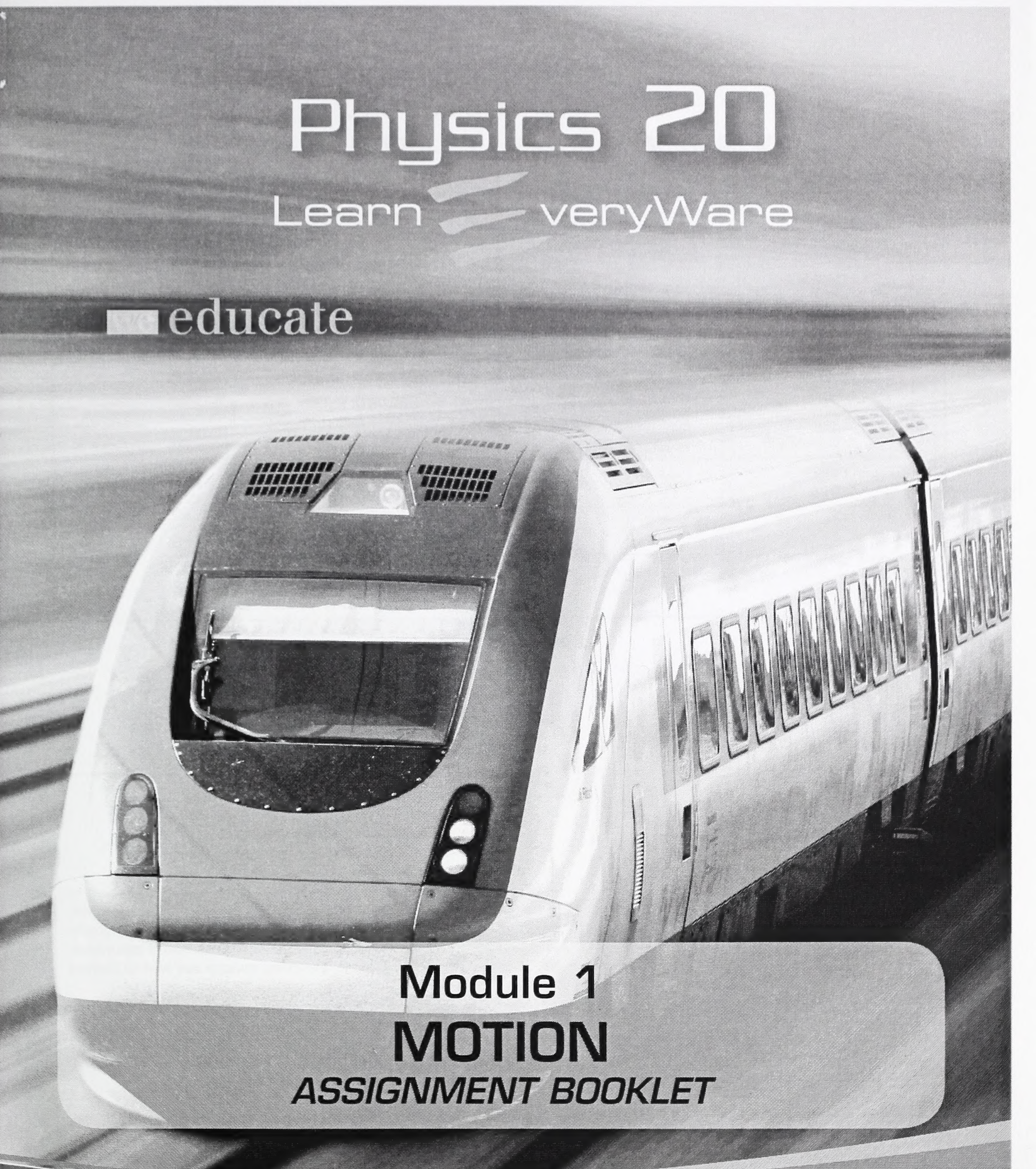

Physics 20

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Module 1

MOTION

ASSIGNMENT BOOKLET

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FOR TEACHER'S USE ONLY

Summary

	Total Possible Marks	Your Mark
Lesson 1 Assignment	39	
Lesson 2 Assignment	37	
Lesson 3 Assignment	78	
Lesson 4 Assignment	49	
Lesson 5 Assignment	20	

Teacher's Comments

Physics 20
Module 1: Motion
Assignment Booklet
ISBN 978-0-7741-3005-9

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Students	✓
Teachers	✓
Administrators	
Home Instructors	
General Public	
Other	

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- Alberta Education, **http://www.education.gov.ab.ca**
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MODULE 1: LESSON 1 ASSIGNMENT

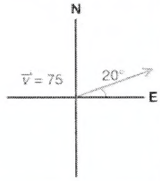
This Module 1: Lesson 1 Assignment is worth 39 marks. The value of each assignment and each question is stated in the left margin.

(39 Marks) **Lesson 1 Assignment: The Language of Motion: Working with Vectors**

(6 marks) **TR 4.** Use the applet in the "Polar (positive)" mode, and set a vector pointing into the first quadrant. Draw and label the vector magnitude and angle in the following table. Draw the same vector in the "Polar (pos & neg)" row of the table. Predict and label the angle in the "Polar (pos & neg)" mode. Repeat this procedure for vectors in the second, third, and fourth quadrants. Verify your answers using the applet.

Polar (positive) Specification	Polar (pos & neg) Specification
Quadrant 1 2 1 3 4 angle: ______	Quadrant 1 2 1 3 4 angle: ______
Quadrant 2 2 1 3 4 angle: ______	Quadrant 2 2 1 3 4 angle: ______
Quadrant 3 2 1 3 4 angle: ______	Quadrant 3 2 1 3 4 angle: ______
Quadrant 4 2 1 3 4 angle: ______	Quadrant 4 2 1 3 4 angle: ______

(5 marks) **TR 6.** Complete the following table by sketching the vectors and labelling the magnitude and direction. (Right click on the table, and select Print Picture to obtain a paper copy of the table.) The first one has been completed as an example. Use the applet to verify your answers. To position the vector, put your cursor on the very tip of the vector arrow, and when a crosshair appears, click, hold, and drag the tip to wherever you wish.

A. mag: 75 dir: 20° N of E  	b. mag: 150 dir: 60° N of W	c. mag: 200 dir: 75° S of E
d. mag: 75 dir: 80° E of N	e. mag: 150 dir: 35° W of N	f. mag: 200 dir: 75° E of S

(5 marks) **TR 11.** The vector, $\vec{v}$, has the following components: $v_x = +65.0$ m/s, $v_y = -120$ m/s

Calculate the magnitude and polar positive direction of the vector, $\vec{v}$. Show your work, and check your solution by setting it up in the simulation.

(5 marks) **TR 12.** Given the vector 225 m/s [35.0°W of S], calculate the *x* and *y* components. Show your work, and check your solution by setting it up in the simulation.

(4 marks) **TR 13.** Working in a group or by yourself, generate and print a map showing how to go from your house to another location, such as your school or work. The other location must be at least one kilometre away and require more than two changes in direction. You may generate and print your map on a separate piece of paper.

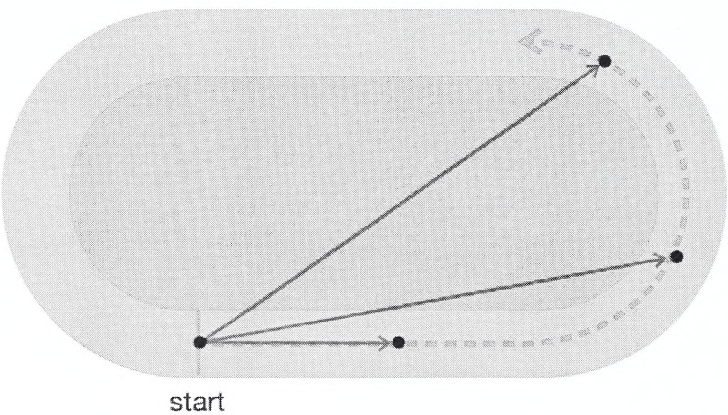
(1 mark) **TR 14.** On the map, draw the vector that shows the displacement from your house to the other location (straight line).

(3 marks) **TR 15.** How can the magnitude and direction of this vector be determined using your map? Define the magnitude and direction using the Cartesian and navigational methods.

(2 marks) **TR 16.** Post your map to the discussion area and view other maps. How did the straight line displacement value (the "as the crow flies" version) compare to the distance value (path length) for your route?

(8 marks) **Discuss**

Average velocity is determined by dividing displacement by time. Position in a chuckwagon race can be illustrated with a vector arrow drawn from the starting point to the current location. The following diagram illustrates several position vectors drawn at different times in the race.



Use this diagram to explain why the displacement becomes zero just as the chuckwagon crosses the finish line and why the chuckwagon has an average velocity of zero when it reaches the finish line. Submit a copy of your response to your instructor, and store a copy in your course folder.

MODULE 1: LESSON 2 ASSIGNMENT

This Module 1: Lesson 2 Assignment Booklet is 37 marks. The value of each assignment and each question is stated in the left margin.

(37 marks)

Lesson 2 Assignment: The Language of Motion: Working with Displacement, Velocity, and Acceleration Vectors

(3 marks) **LAB 4.** Calculate the displacement (magnitude and direction) of the ball when it is moved from the initial to the final position.

- initial position $(x, y)_i = (-10.0, 10.0)$ m
- final position $(x, y)_f = (15.0, -10.0)$ m

Show your work, and use the simulation to verify that the answer you calculated is correct.

(2 marks) **LAB 6.** In general, the distance travelled will be __________ than the magnitude of the displacement. The two will be equal only when the path taken is a ___________ line and when the path is traversed in a single direction (no backtracking).

(2 marks) **LAB 8.** Calculate the average speed and the average velocity for a ball that is moved according to the following instructions.

- Reset () the simulation, and position () the ball at $(x, y)_i = (10.0, -5.0)$ m.
- Drag the ball along any curved path to somewhere near $(x, y)_f = (-20.0, -10.0)$ m.

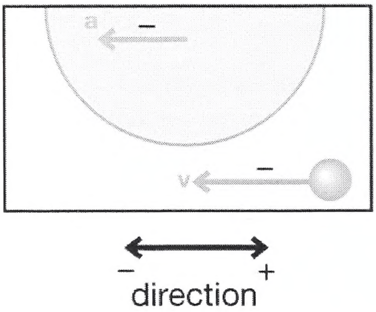
a. Show the average speed calculations.

(2 marks) b. Show the average velocity calculations.

(3 marks) **LAB 10.** Why is the average speed always greater than the magnitude of the average velocity?

(2 marks) **LAB 13.** According to figure below, the velocity and acceleration have a negative direction. Compare this to your observations from question 1.

a. Does a negative acceleration necessarily mean that something is slowing?



(1 mark) b. What orientation of velocity and acceleration will cause something to initially slow down?

(1 mark) c. What orientation of velocity and acceleration will cause something to initially speed up?

(2 marks) **LAB 15**. Set up the simulation to illustrate the motion of a baseball that is thrown straight up.

a. Above each of the following words, draw the initial velocity vector and the constant acceleration vector.

velocity acceleration

(2 marks) b. Is there a point on the trajectory where the ball has zero velocity? Where on the trajectory does this occur?

(3 marks) c. Is there a point on the trajectory where the ball has zero acceleration? Explain.

(2 marks) **LAB 17.** Based on your observations from the simulation, do you think it is possible for an object to accelerate yet neither speed up nor slow down? Explain why or why not.

(3 marks) **LAB 18.** Based on your observations from all the previous exercises, it is clear that acceleration will change the magnitude and/or direction of the velocity. With this in mind, complete the following list of accelerators common to all vehicles.

a. the ________________________, which causes an acceleration that maintains or changes the car's velocity, controlled by the gas pedal

b. the _________, which causes an acceleration that opposes the car's velocity, controlled by the brake pedal

c. the ___________________, which causes an acceleration that changes only the direction of the car's velocity

Recall the questions about displacement, velocity, and acceleration in the Get Focused section at the beginning of this lesson. If two Smart cars depart from the same location at the same time and travel different routes to the same final destination, arriving at the same time, prepare to explain why the following statements are true. Then submit your answers to your teacher for marking.

(3 marks) **TR 2.** The cars have travelled different distances but have the same displacement.

(2 marks) **TR 3.** The average velocity of each car is identical even though they travelled at different speeds.

(2 marks) **TR 4.** When the brakes on the cars were used, the acceleration was not necessarily negative.

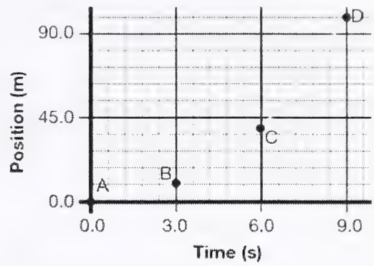
(2 marks) **TR 5.** The steering wheel on each car was used to change the velocity of the car without changing the speed.

MODULE 1 LESSON 3 ASSIGNMENT

This Module 1: Lesson 3 Assignment is worth 78 marks. The value of each assignment and each question is stated in the left margin.

(78 marks) **Lesson 2 Assignment: Graphical Analysis of Uniform Motion**

TR 1. Jordan is motorcycling along a straight path. The position-time graph illustrates his position (measured from the starting position) plotted against time. What can this graph tell you about Jordan's movement and location?



(4 marks) a. Describe Jordan's position at the following points:

A: ______ m, B: ______ m, C: ______ m, D: ______ m

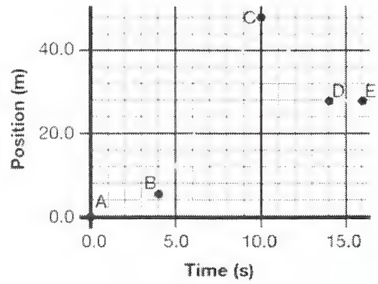
(1 mark) b. What is his displacement in the first 3.0 s?

(1 mark) c. What is his displacement in the first 9.0 s?

(2 marks) d. What is his displacement when motorcycling from point B to point D?

(3 marks) e. Is all of the motion in the same direction? How do you determine this by using the graph?

TR 2. A basketball rolls across the gym floor, is hit by another ball, bounces off the far wall, and gets trapped under a chair on the gym floor.



(2 marks) a. What was the ball's displacement when it hit the far wall of the gym, and how long did it take to get there?

__________ m, ___________ s

(1 mark) b. What is different about the ball's motion from 4 s to 10 s (from point B to point C) compared to the motion from 10 s to 14 s (from point C to point D)?

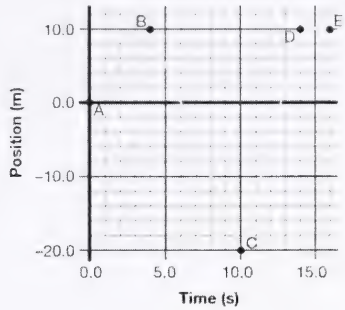
(4 marks) c. Use the terms *forward*, *backward*, and *stopped* to describe the motion of the ball between the following points:

A–B ____________________ B–C ____________________

C–D ____________________ D–E ____________________

(1 mark) d. How far away is the chair from the far wall of the gym?

TR 3. A lawn mower is pushed along a straight path. The graph shows the position of the mower over a 16.0-s time interval.



(1 mark) a. How many times was the mower at the starting position?

(2 marks) b. Where is position C relative to the starting position—in front or behind? Is this a positive (+) or negative (–) position?

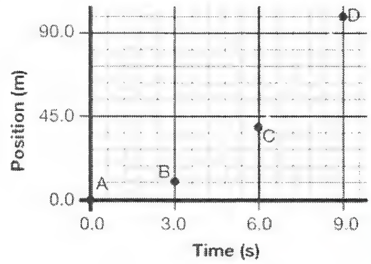
(2 marks) c. Which two motions are in the same direction?

A. A–B and B–C
B. A–B and C–D
C. B–C and D–E
D. B–C and C–D

(4 marks) d. The motion switched direction two times. At which two points did the direction of the motion reverse? Explain how this is indicated on the graph.

(4 marks) e. Explain how the position-time graph for the lawn mower could be used to develop an automated program to control the motion of a self-propelled mower.

TR 4. Calculate the velocity (slope) for each time interval in the following position-time graph. Show all of your work, including correct units and directions using a positive/negative x-axis.



(2 marks) a. velocity from point A to point B

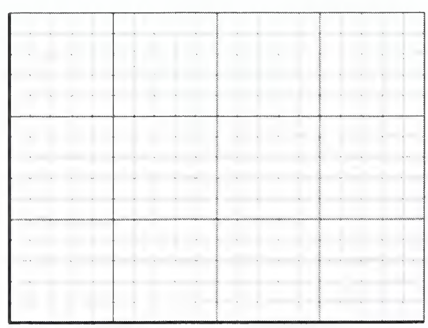
(2 marks) b. velocity from point B to point C

(2 marks) c. velocity from point C to point D

TR 6. On the simulation, click "reset" ( ). Clear all motion steps from the simulation by clicking each motion step and clicking "remove" ( ).

Enter the following new motion steps on the simulation by clicking "add" ( ):

- 5.0 s at +4.0 m/s
- 3.0 s at +14.0 m/s
- 2.0 s at +6.0 m/s

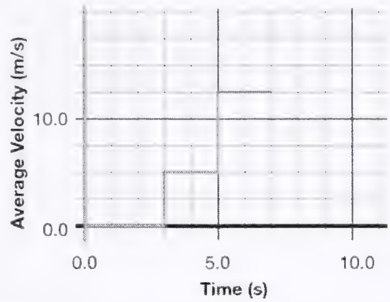


(4 marks) a. Play the motion, and generate the position-time graph. Draw the graph on the grid to the right.

3 marks)

b. Using the slope button, determine and label the velocity for each time interval on your graph.

TR 8. A car travels along a straight road. The following simplified graph shows the car's average velocity over several selected time periods during a 7.0-s time interval.



(1 mark) a. What was the average speed of the car during the 0.0–3.0 s time interval?

______m/s

(1 mark) b. What was the average speed of the car during the 3.0–5.0 s time interval?

______m/s

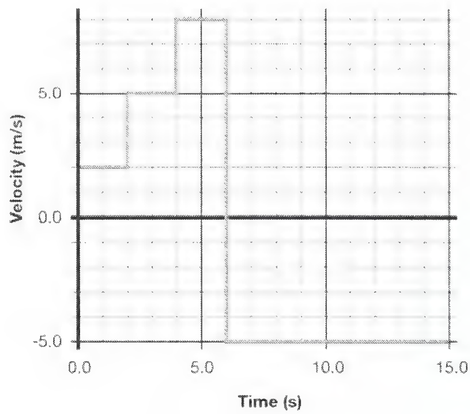
(1 mark) c. What was the average speed of the car during the 5.0–7.0 s time interval?

______m/s

(3 marks) d. Using $v_{ave} = \frac{\Delta d}{\Delta t}$, calculate how far the car travels during the 0.0–3.0 s time interval.

(3 marks) e. How could you determine the distance that the car would travel for the entire 7-s interval?

TR 10. An elevator moves up and down between floors in a building. The following graph shows the velocity of an elevator that was moving over a 15.0 s time interval.



(2 marks) a. What is the fastest velocity? During what time interval does this occur?

(2 marks) b. What is the lowest velocity? During which time interval does this occur?

(3 marks) c. Does the elevator move in two different directions? How can this be determined using the graph, and how is this illustrated using the *x*-axis?

(4 marks) d. The graph illustrates four distinct "phases" for the motion. Complete the following table, and then enter these values into the simulation to reproduce the horizontal equivalent of the elevator's motion.

Time Interval (s)	Velocity (m/s)

TR 11. A ball rolls along a straight path with the following velocity and time intervals:

- 3.0 s at +15.0 m/s
- 7.0 s at +20.0 m/s
- 6.0 s at –30.0 m/s
- 4.0 s at +3.5 m/s

Use the simulation to produce a velocity-time graph. Click the area "Integrate" button (), and sweep out the area from **left to right** to determine the following:

(1 mark) a. total displacement:

_______ m

(1 mark) b. displacement in the first 10 s:

_______ m

(1 mark) c. displacement in the last 10 s:

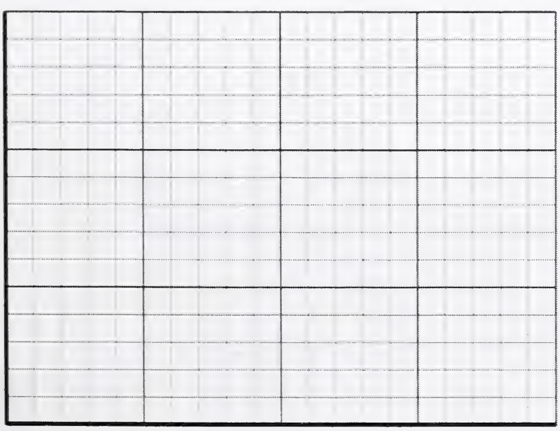
_______ m

(1 mark) d. displacement in the 5.0–15.0 s time interval:

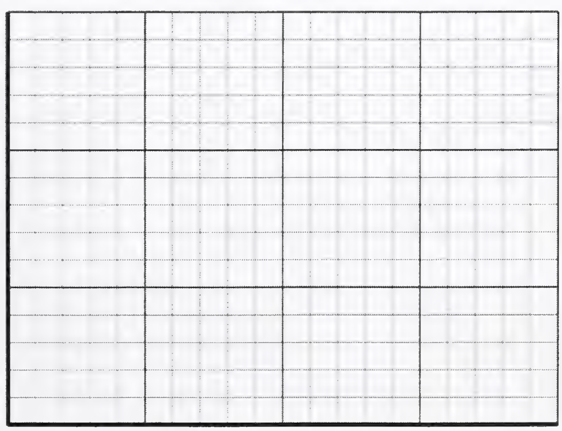
_______ m

(6 marks) **TR 12.** Marly is sprint cycling and gets off to a good start, pedalling at a rate of 12.0 m/s for 10.0 s. She tires and slows down to 9.80 m/s for the next 16.0 s. When she gets close to the finish line, she begins pedalling at 11.5 m/s for the next 2.0 s. Sketch her position-time graph and velocity-time graph.

Position-Time Graph



Velocity-Time Graph



(6 marks) **TR 13.** Marly's competitor, Michelle, starts the race at the same position and same time as Marly. However, she has a different strategy. Michelle pedals at a rate of 8.0 m/s for 8.0 s. She then speeds up to 15.0 m/s for the next 14.0 s. When she gets close to the finish line, she is tired and can only pedal at 10.0 m/s for the last 2.6 s. Sketch her position-time graph over top of Marly's position-time graph.

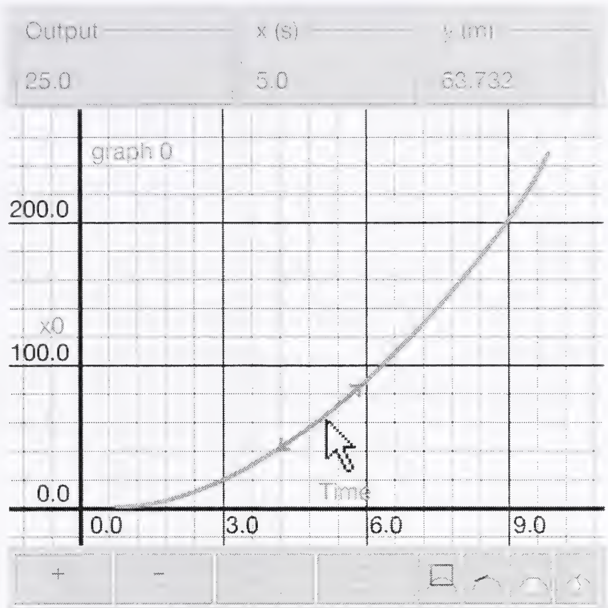
(5 marks) **TR 14.** Come to the discussion area ready to share and discuss your graphs. Also, be prepared to discuss how you would determine where and when the two cyclists would meet and which strategy worked best if the race was only 250 m long.

MODULE 1: LESSON 4 ASSIGNMENT

This Module 1: Lesson 4 Assignment is worth 49 marks. The value of each assignment and each question is stated in the left margin.

(49 marks) **Lesson 4 Assignment: Graphical Analysis of Accelerated Motion**

(2 marks) **LAB 1.** Explain how you can tell that the motion of the shuttle is speeding up. In your explanation, refer to the term *slope*.



LAB 2. Use the position–time graph to complete the following tasks.

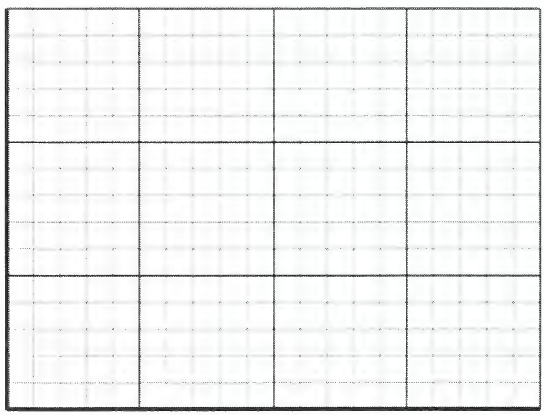
(2 marks)

a. Complete the following table. (Click the "Slope Mode" button, , and put your cursor on the exact time value on the graph line for the point you wish to examine. The time value is displayed at the top under the "x". The velocity will be displayed under Output.)

Time (s)	Velocity (slope) m/s
0	
2	
4	
6	
8	

(3 marks)

b. Using the velocity data collect in LAB 2.a., complete a velocity-time graph for the space shuttle launch.



(1 mark) **LAB 3.** Which of the following best describes the shuttle launch velocity-time graph?

A. The graph is constant and of the mathematical form $y = b$, where b is a constant.

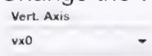
B. The graph is linear and of the mathematical form $y = mx + b$, where b is a constant and m is the slope.

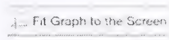
C. The graph is a quadratic curve and of the form $y = ax^2 + bx + c$, where a, b, and c are coefficients.

(1 mark) **LAB 4.** Write an equation expressing the relation between velocity and time.

LAB 5. Use the simulation to create a velocity-time graph based on the same time, velocity, and acceleration values that were entered in the procedure.

- Change the *vertical* axis ("Vert. Axis") to show velocity ("vx0").



- Click "Fit Graph to the Screen." 

- Verify that this graph is identical to the velocity-time graph you created in LAB 2.

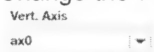
(1 mark) a. Calculate the slope mathematically, and verify your answer using the slope tool on the simulation.

(1 mark) b. What are the units that correctly describe the slope of a velocity-time graph? (**Hint:** Make sure you put the units into your calculation in LAB 5.a. and that you computed them.)

(1 mark) c. What does the slope on a velocity-time graph mean? That is, what quantity of motion does the slope measure?

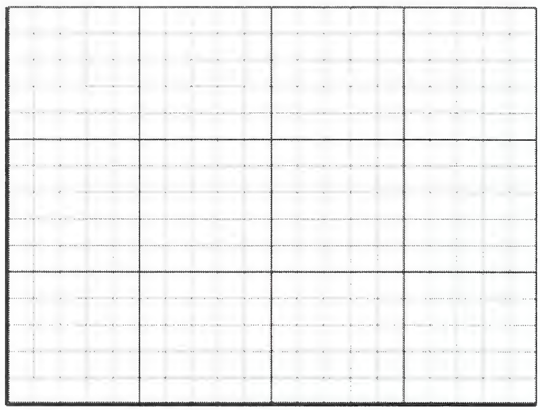
LAB 6. Use the simulation to create an acceleration-time graph based on the same time, velocity, and acceleration values that were entered in the procedure.

- Change the vertical axis (“Vert. Axis”) to show acceleration (“ax0”).



- Click “Fit Graph to the Screen.” 

(3 marks) a. Complete an acceleration-time graph.



(1 mark) b. In LAB 5 you determined the slope of the velocity-time graph for the shuttle launch. Where or how does that "appear" on the acceleration-time graph?

(2 marks) c. Is the slope of graph 2 equal to zero? What does this mean?

LAB 8. Each of the measured areas is a rectangle. You will recall that the area of a rectangle is calculated as length × height.

(1 mark) a. What are the units of length for each rectangle?

(1 mark) b. What are the units of height for each rectangle?

(2 marks) c. Multiply the units of length and height to determine the units of area for each rectangle. What variable is the area describing?

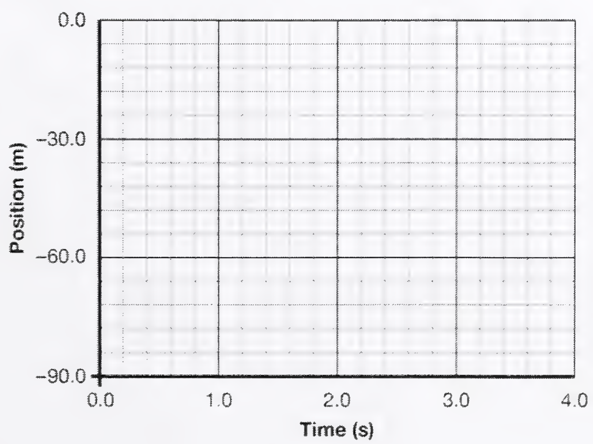
LAB 11. Each of the measured areas is a triangle. The calculation of the area of a triangle is ½ length × height.

(1 mark) a. What are the units of length for each triangle?

(1 mark) b. What are the units of height for each triangle?

(2 marks) c. Multiply the units of the length (s) by the unit of height (m/s). What variable is the area describing?

(2 marks) **LAB 12.** a. Plot the data collected in LAB 10.



(3 marks) b. Explain what this graph shows.

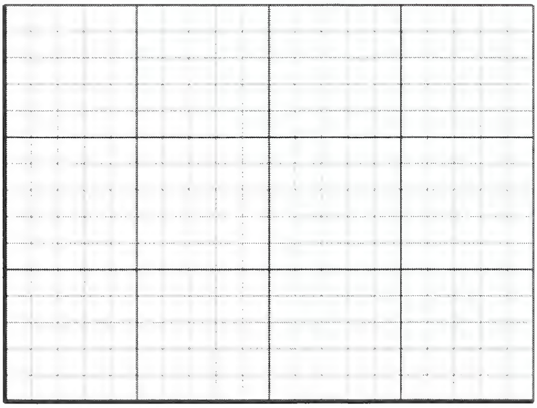
(2 marks) c. Why are all of the positions negative?

TR 1. You are riding in an elevator. Starting from rest, the elevator undergoes the following motions:

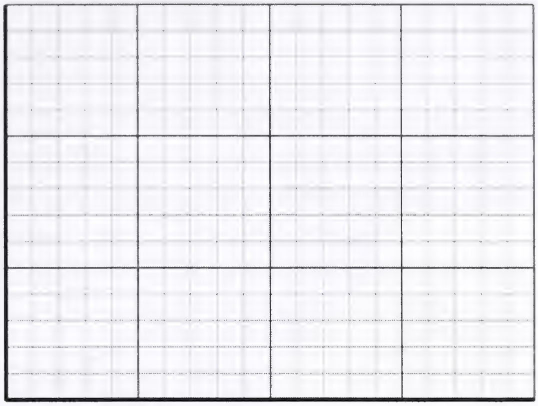
- It accelerates from rest (v = 0.0 m/s) upwards for 5.0 s at +2.0 m/s^2.
- It then coasts for 20.0 s at 10.0 m/s (a = 0.0 m/s^2).
- Finally, starting at 10.0 m/s, it accelerates downward for 2.5 s at –4.00 m/s^2.

Complete the following graphs.

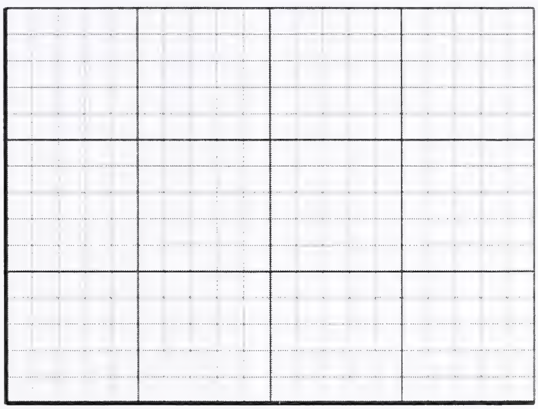
(3 marks) a. position-time



(3 marks) b. velocity-time



(3 marks) c. acceleration-time



(1 mark) d. Using the slope of the position-time graph, determine the maximum speed reached by the elevator.

(1 mark) e. Using area, determine how far the elevator travelled while coasting.

(1 mark) f. Using area, determine how far the elevator travelled while accelerating downward.

(4 marks) **TR 2.** Basam is standing on the edge of a cliff and tosses her physics book upward with a speed of 22.0 m/s. It hits the ground at the base of the cliff 6.0 s later. Use the 1D Non-Uniform Motion Builder Graphing (pos, vel, acc) simulation to determine how high the cliff is and how fast the book was moving when it landed.

MODULE 1: LESSON 5 ASSIGNMENT

This Module 1: Lesson 5 Assignment is worth 20 marks. The value of each assignment and each question is stated in the left margin.

(20 marks) **Lesson 5 Assignment: Kinematics Equations Describe Acceleration, Displacement, and Velocity**

(2 marks) **TR 1.** A homing pigeon starts from rest and accelerates uniformly at +4.00 m/s^2 for 10.0 s. What is the velocity after the acceleration?

TR 2. A car has an initial velocity of +30.0 m/s and undergoes an acceleration of –5.00 m/s^2 for 5.00 s.

(2 marks) a. Find the velocity after the acceleration.

(2 marks) b. Find the velocity after the acceleration.

TR 3. A rocket sled that was initially at rest reaches a final speed of +30.0 m/s over a displacement of +45.0 m.

(2 marks) a. Find the acceleration.

(2 marks) b. Find the time it took to travel the first 45.0 m.

(2 marks) **TR 4.** A water balloon is dropped on some unsuspecting sunbathers from a stationary hot air balloon. The water balloon is 353 m above the beach. If the water balloon accelerates downwards at 9.81 m/s^2, how long will it take to hit the beach?

(3 marks) **LAB 1.** Complete steps 1–7 of “Procedure” on page 57 of your textbook. For step 6, you should complete at least three trials. List your trial results.

(1 mark) **LAB 2.** Answer question 1 on page 57 of your textbook.

(2 marks) **LAB 3.** Answer question 2 on page 57 of your textbook.

(1 mark) **LAB 4.** Answer question 3 on page 57 of your textbook.

(1 marks) **LAB 5.** Answer question 4 on page 57 of your textbook.

Once you have completed all of the questions, submit your work to your teacher.